

ABSTRACT

Typically 20-40 films of a tough first metal, normally .1-1.0 mm thick films of titanium, nickel, vanadium, and/or steel (iron) and alloys thereof, interleaved with a like number of films of a second metal, normally .1-1.0 mm thick films of aluminum or alloys thereof, are pressed together in a stack at less than 6 MPa and normally at various pressures 2-4 MPa while being gradually heated in the presence of atmospheric gases to 600-800 °C over a period of, typically, 10+ hours until the second metal is completely compounded; forming thus a metallic-intermetallic laminate composite material having (i) tough first-metal layers separated by (ii) hard, Vickers microhardness of 400 kg/mm²+, intermetallic regions consisting of an intermetallic compound of the first and the second metals. The resulting composite material is inexpensive, lightweight with a density of typically 3 to 4.5 grams/cubic centimeter, and very hard and very tough to serve as, among other applications, lightweight armor. Upon projectile impact (i) the hard intermetallic, ceramic-like, layers are confined by the tough metal layers while (ii) cracking and fracturing is blunted and channeled in directions orthogonal to the axis of impact.